

**INSTALLATION MANUAL
OF STARDAND SOLAR
MODULES (UL)**

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1.0 GENERAL INFORMATION

This general manual provides important safety information relating to the installation, maintenance and handling of CS-series solar modules. System users and professional installers should read this manual carefully and strictly follow the instructions herein. Failure to follow these instructions may result in death, injury or property damage. The installation of solar modules requires specialized skills and should only be performed by licensed professionals. The word "module" or "PV module" used in this manual refers to one or more CS-series solar modules. Please retain this manual for future reference. We recommend checking www.canadiansolar.com regularly for the most updated version.

1.1 INSTALLATION MANUAL DISCLAIMER

The information contained in this manual is subject to change by Canadian Solar Inc. without prior notice. Canadian Solar Inc. gives no warranty of any kind whatsoever, either explicitly or implicitly, with respect to the information contained herein.

1.2 LIMITATION OF LIABILITY

Canadian Solar Inc. shall not be held responsible for damages of any kind, including – without limitation – bodily harm, injury or damage to property, in connection with handling PV modules, system installation, or compliance or non-compliance with the instructions set forth in this manual.

2.0 SAFETY PRECAUTIONS



Warning: Before attempting to install, wire, operate and/or service the module and other electrical equipment, all instructions should be read and understood.

PV module interconnectors pass direct current (DC) when exposed to sunlight or other light sources. Contact with electrically active parts of the module, such as terminals, can result in injury or death, irrespective of whether or not the module and the other electrical equipment have been connected.

GENERAL SAFETY

- All Modules must be installed by licensed electricians in accordance to the applicable electrical codes such as, the latest National Electrical Code (USA) or Canadian Electric Code (Canada) or other national or international electrical codes.



Protective clothing (non-slip gloves, clothes, etc.) must be worn during installation to prevent direct contact with 30 V DC or greater, and to protect your hands against sharp edges.



Prior to installation, remove all metallic jewelry to prevent accidental exposure to live circuits.



When installing or handling modules in light rain, morning dew or strong wind, take appropriate safety measures to avoid damage to the modules or injuries to people.

- Use electrically insulated tools to reduce the risk of electric shock.
- If the disconnects and OCPD's cannot be opened or the inverter cannot be powered down, cover the fronts of modules in the PV array with an opaque material to stop the production of electricity when installing or working on a module or wiring.
- **Do not** use or install broken modules.
- Contact with module surfaces or frames may cause electric shock if the front glass is broken or the backsheet is torn.
- Keep the junction box cover closed at all times.
- The PV module does not contain any serviceable parts. **Do not** attempt to repair any part of the module.
- **Do not** disassemble a module or remove any module part.
- **Do not** artificially concentrate sunlight on a module.
- **Do not** connect or disconnect modules when current from the modules or an external source is present.
- **Do not** allow children or unauthorized persons near the installation site or module storage area.

Safety in Hazardous Locations

- With regard to modules that are suitable for use in Class I, Division 2, Groups A, B, C and D hazardous locations, strict compliance with the following WARNINGS is necessary to avoid any personal injury or damage to property.



Warning: Explosion hazard – do not disconnect equipment unless the power has been switched off or the area is known to be non-hazardous.
 Avertissement: Risque d'explosion – Avant de déconnecter l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux

3.0 MECHANICAL / ELECTRICAL SPECIFICATIONS

Module electrical ratings are measured under Standard Test Conditions (STC) of 1000 W/m² irradiance, with an AM1.5 spectrum, and a cell temperature of 25°C. Detailed electrical and mechanical characteristics of Canadian Solar Inc. crystalline silicon PV modules can be found in our Installation Manual Annex (Section Annex C: Module Specifications) on www.canadiansolar.com. Main electrical characteristics under STC are also stated on each module label. The maximum system voltage for all modules series is either 600 V or 1000 V. Please refer to the datasheet or the product nameplate for the maximum system voltage.

Under certain conditions, a module may produce more current or voltage than under its Standard Test Condition's rated power. As a result, a module's open-circuit voltage and short-circuit current under STC should be multiplied by 1.25 when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and the size of controls connected to the PV output. An additional 1.25 multiplier for the short-circuit current (giving a total multiplier of 1.56), may be applicable when sizing conductors and fuses, as described in section 690-8 of U.S. NEC.

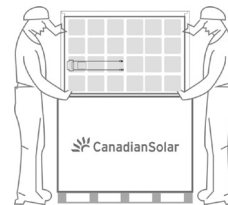
4.0 UNPACKING AND STORAGE PRECAUTIONS

NOTICE

PRECAUTIONS

If modules are stored in an uncontrolled environment for less than 3 months, extra precautions should be taken to prevent moisture exposure to connectors or sunlight exposure to modules.

- Unpack module pallets carefully, following the steps shown on the pallet. Unpack, transport and store the modules with care.
- Modules must always be unpacked by two people. Always use both hands when handling modules.



- **Do not** lift modules by their wires or junction box, lift them by the frame.
- Stacks of modules should contain no more than 12 modules, and the frames should be aligned.
- **Do not** place excessive loads on the module or twist the module frame.
- **Do not** bow modules under their own weight.
- **Do not** stand, step, walk and/or jump on modules.



- **Do not** drop or place objects (such as tools) on the modules.
- **Do not** carry modules on your head.
- **Do not** use sharp instruments on the modules. Particular care should be taken to avoid module backsheets being damaged by sharp objects, as scratches may directly affect product safety.
- **Do not** leave modules unsupported or unsecured.
- **Do not** change the wiring of bypass diodes.
- Keep all electrical contacts clean and dry.

PRODUCT IDENTIFICATION

- Each module is equipped with two identical barcodes (one inside the laminate under the front glass, the second on the rear side of the module) that act as a unique identifier. Each module has a unique serial number containing 13 (pre March 2013) or 14 (post March 2013) digits.
- A nameplate is also affixed to the rear of each module. This nameplate specifies the model type, as well as the main electrical and safety characteristics of the module.

5.0 MODULE INSTALLATION

PRECAUTIONS MEASURES AND GENERAL SAFETY



Prior to installing modules please obtain information about any requirements and necessary approvals for the site, installation and inspection from the relevant authorities.

SYSTEM FIRE RATING

- The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions.
- Canadian Solar Inc. modules have been certified by CSA as Type 1 for fire performance.
- When installing the modules on rooftop, please ensure the assembly is mounted over a fire resistant roof covering rated for the application.
- A photovoltaic systems composed of UL1703 certified modules mounted on a UL2703 certified mounting system should be evaluated in combination with roof coverings in accordance with UL1703 standard, with respect to meeting the same fire classification as the roof assembly.
- Mounting systems with a System Fire Class Rating (Class A, B or C), tested in conjunction with fire rated "Type 1" rated modules, are considered acceptable for use with Canadian Solar Inc. modules, provides the mounting system does not violate any other requirements of this manual.
- Any mounting system limitations on inclination or accessories required to maintain a specific System Fire Class Rating should be clearly specified in the installation instructions and UL2703 certification of the mounting system supplier.

Please note **DO NOT STAND OR STEP** on the modules under any circumstances.

Localized heavy loads may cause severe micro-cracks at cell level, which in turn may compromise module reliability. Failure to comply with the above caution will void Canadian Solar Inc.'s warranty.

ENVIRONMENTAL CONDITIONS

- The module is intended for use in general open-air climates, as defined in IEC 60721-2-1: Classification of environmental conditions Part -2-1: Environmental conditions appearing in nature - Temperature and humidity.
- Please consult the Canadian Solar Inc. technical support department for more information on the use of modules in special climates.



Do not install modules near naked flames or flammable materials.



Do not immerse modules in water or constantly expose modules to water (either fresh or salt) (i.e. from fountains, sea spray).

- Exposing modules to salt (i.e. marine environments) or sulfur (i.e. sulfur sources, volcanoes) incurs the risk of module corrosion.
- Failure to comply with these instructions will void Canadian Solar Inc warranty.

INSTALLATION REQUIREMENTS

- Ensure that the module meets the general technical system requirements.
- Ensure that other system components do not damage the module mechanically or electrically.
- Modules can be wired in series to increase voltage or in parallel to increase current. To connect modules in series, connect the cables from the positive terminal of one module to the negative terminal of the next module. To connect in parallel, connect the cables from the positive terminal of one module to the positive terminal on the next module.
- The quantity of bypass diodes in the module's junction box may vary depending on the model series.
- Only connect the quantity of modules that corresponds to the voltage specifications of the inverters used in the system. Modules must NOT be connected together to create a voltage higher than the maximum permitted system voltage, even under the worst local temperature conditions.

- Only modules with similar electrical outputs should be connected in the same string to avoid or minimize mismatch effects in arrays.
- To minimize risk in the event of an indirect lightning strike, avoid forming loops when designing the system.
- The recommended maximum series fuse rating is stated in a table in the Annex.
- Modules should be safely fixed to bear all expected loads, including wind and snow loads. A minimum clearance of 0.25 in (6.5 mm) or more between modules is required to allow for thermal expansion of the frames.
- The small drainage holes on the underside of the module must not be blocked.

OPTIMUM ORIENTATION AND TILT

- To maximize your annual yield, find out the optimum orientation and tilt for PV modules in your region. The highest yields are achieved when sunlight shines perpendicularly onto the PV modules.

AVOID SHADING

- Even minor partial shading (e.g. from dirt deposits) reduces yields. A module can be considered to be unshaded if its entire surface is free from shading all year round. Sunlight should be able to reach the module even on the shortest day of the year.

RELIABLE VENTILATION

- Sufficient clearance (at least 3.94 in (10 cm)) between the module frame and the mounting surface is required to allow cooling air to circulate around the back of the module. This also enables for condensation or moisture to dissipate.
- Any other specific clearance required for maintaining a system fire rating should prevail. Detailed clearance requirements pertaining to system fire ratings must be provided by your racking supplier.

5.1 MODULE WIRING

CORRECT WIRING SCHEME

- Ensure that the wiring is correct before starting up the system. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ substantially from the specifications, this indicates that there is a wiring fault.

CORRECT CONNECTION OF PLUG CONNECTORS

- Make sure that connections are safe and tight. Plug connector should not be subjected to stress from the exterior. Connectors should only be used to connect the circuit. They should never be used to turn the circuit on and off.

USE OF SUITABLE MATERIALS

- Only use dedicated solar cable and suitable plugs (wiring should be sheathed in a sunlight-resistant conduit or, if exposed, should be sunlight-resistant itself) that meet local fire, building and electrical regulations. Please ensure that all wiring is in perfect electrical and mechanical condition.
- Installers may only use single conductor cable listed and labeled as USE-2 or PV Wire that is 90°C wet rated with proper insulation that is able to withstand the maximum possible system open-circuit voltage. Only copper conductor material should be used. Select a suitable conductor gauge to minimize voltage drop and ensure that the conductor ampacity complies with local regulations (i.e. NEC 690.8(D)).

CABLE PROTECTION

- Secure the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage by taking appropriate precautions (e.g. placing them inside a plastic conduit). Avoid exposure to direct sunlight.
- A minimum bending radius of 2.36 in (60 mm) is required when securing the junction box cables to the racking system.

5.2 EQUIPMENT GROUNDING

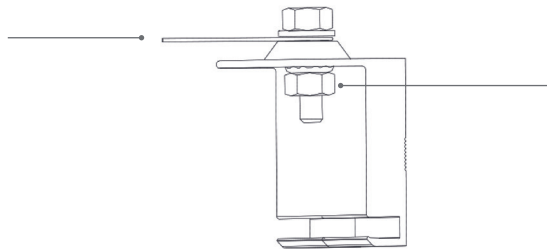
- A module with exposed conductive parts is only considered to comply with UL1703 only when it is electrically grounded in accordance with both the instructions presented below and the requirements of the National Electrical Code.
- Modules must be grounded, and module installation must comply with all local electrical codes and regulations.
- Grounding connections should be installed by a qualified electrician.
- Any grounding means used with Canadian Solar Inc. modules should be NRTL certified to UL467 and UL2703 standards. Please consult your sales representative for formal approval process.
- Connect module frames to together using suitable grounding conductor. Holes provided for this purpose are identified with a grounding symbol.
- Use 6-12 AWG (4-14 mm²) copper wire only. All bolts, nuts, flat washers, lock washers and other relevant hardware should be made of stainless steel, unless otherwise specified.
- All conductive connection junctions must be firmly fixed. Metal containing iron in the conductive connection should be made with stainless steel or be treated against corrosion by anodizing, spray-painting, or galvanization to prevent rusting and corrosion.
- Canadian Solar Inc. does not provide grounding hardware.
- One grounding method approved by North-American certification bodies is recommended for Canadian Solar modules, as described below. For alternative grounding methods, please refer to our Installation Manual Annex (Section Annex B: Alternative Grounding Methods) on the website (www.canadiansolar.com). It is not possible to use standard grounding methods for certain module ranges. Please refer to Annex B for more details.

**GROUNDING METHOD:
BOLT + TOOTHED NUT + CUP WASHER.**

When diameter of the grounding holes is 0.20 in (5 mm) (CSA certified).

- A grounding kit containing an M5 SS cap bolt, an M5 SS flat washer, an M5 SS cup washer, and an M5 SS nut (with teeth) is used to attach copper grounding wire to a pre-drilled grounding hole on the frame (see image below).
- Place the wire between the flat washer and the cup washer. Ensure that the cup washer is positioned between the frame and the wire with the concave side up to prevent galvanic corrosion. Tighten the bolt securely using the SS toothed nut. A wrench may be used to do this. The tightening torque is 1 Nm (0.8 ft-lbs).

To fix the wire between the flat washer and cup washer, place the cup washer (concave side up) between the frame and the wire.

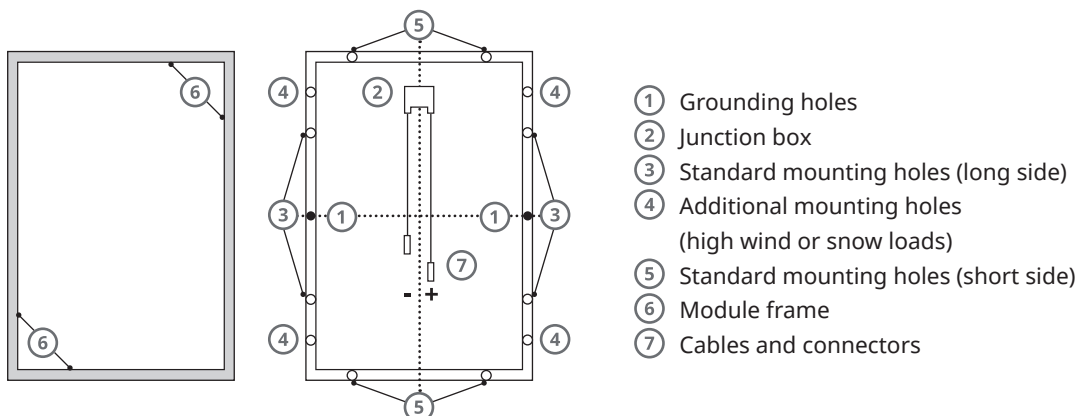


Then tighten the bolt using the toothed nut.

6.0 MOUNTING INSTRUCTIONS

STANDARD MODULES

- For a clear understanding of our modules, please refer to the illustration of a standard module shown below:



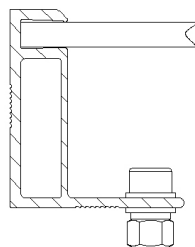
- The mounting design must be certified by a registered professional engineer. The mounting design and procedures must comply with local codes and requirements from all relevant authorities.
- The module is only considered to comply with UL 1703 when mounted as specified in the instructions below.
- All installation methods listed in CSI installation manual (including in Annex) have been qualified by major North-American certification bodies (CSA, or Intertek).
- Canadian Solar Inc. does not provide mounting hardware.
- Canadian Solar Inc. modules can be mounted onto a support structure using one of several approved methods. One such method is described below. For details of other mounting methods and the methods recommended by Canadian Solar Inc. for special module ranges, please refer to our Installation Manual Annex (Section Annex A: Alternative Mounting Methods) on our website (www.canadiansolar.com). For information about other installation hardware, please contact your local representative. Failure to use a recognized installation method will void the Canadian Solar Inc. warranty.
- Use appropriate corrosion-proof fastening materials. All mounting hardware (bolts, spring washers, flat washers, nuts) should be made with stainless steel.
- **Do not** drill additional holes or modify the module frame. Doing so will void the warranty.
- Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 1703 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field inspection certifying that the installed module complies with the requirements of UL 1703.
- Canadian Solar Inc. modules can be installed in either landscape or portrait orientations. Refer to the detailed instructions for further guidance. Please note that in areas with heavy snowfall (> 2400 Pa) further countermeasures such as the use of additional support bars should be considered to avoid snow loads damaging the lowest row of modules.
- In cases where an additional support bar is recommended to improve both mechanical stability and long-term module performance, Canadian Solar recommends selecting sufficiently resistant material. Canadian Solar Inc. recommends bars with a minimum thickness of 1.97 in (50mm). The support bar centerline should be positioned within 3.94 in (100 mm) of the side frame centerline (slight shifts may be necessary to access module grounding holes).
- Use a torque wrench for installation.

6.1

MOUNTING METHOD: BOLTING

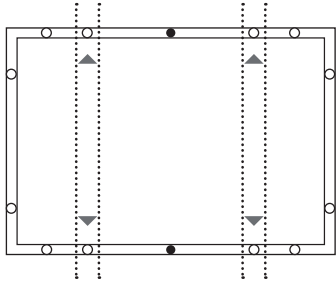
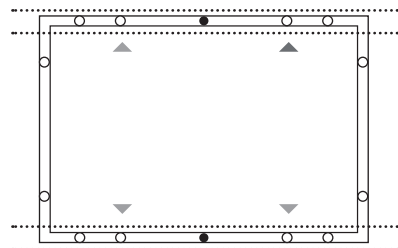
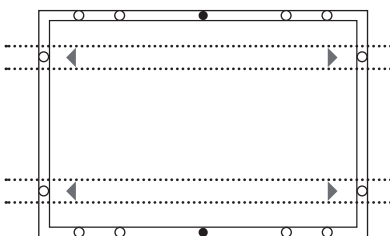
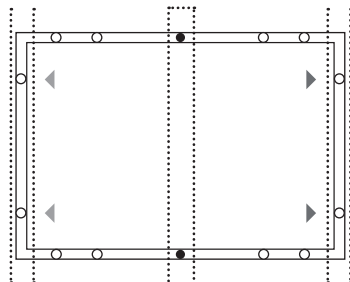
- Modules should be bolted to support structures through the mounting holes in the rear frame back flanges only.
- Each module must be securely fastened at a minimum of 4 points on two opposite sides, using the innermost mounting holes. M6 size bolt and nut shall be used for bolting method. Tightening torques should be within 4 ~ 6 Nm (3.0 - 4.4 ft-lbs) for M6x1 coarse thread bolts, depending on bolt class. In areas with heavy wind loads, additional mounting points should be used. The system designer and the installer are responsible for calculating the loads and ensuring that the support structure meets the requirements.

Mounting Method: Bolting (INTEETEK and CSA qualified)



- Modules should be bolted at the following hole locations depending on the configuration and load:

Table 1: Approved bolting methods

	Uplift load ≤ 2400 Pa Downforce load ≤ 2400 Pa	Uplift load ≤ 2400 Pa 2400 Pa $\leq$ Downforce load ≤ 5400 Pa
Bolting on long side frame	 Use 4 standard mounting holes (long side) Mounting rails shall run perpendicularly or parallel to the long side frame	
Bolting on short side frame (except for CS6X series)	 Use 4 standard mounting holes (short side) Mounting rails shall run parallel or perpendicularly to the short side frame	 Use 4 standard mounting holes (short side). An additional support bar should be placed below the module Mounting rails should run parallel to the short side frame

7.0 MAINTENANCE

- Regular maintenance is required to keep modules clear of snow, bird droppings, seeds, pollen, leaves, branches, dirt spots, and dust.
- Modules with sufficient tilt (at least 15°), generally do not require cleaning (rain will have a self-cleaning effect). If the module has become soiled, it shall be washed with water and a non-abrasive cleaning implement (sponge) during the cool part of the day. Do not scrape or rub dry dirt away, as this may cause micro scratches.
- Snow should be removed using a soft brush.
- The system shall be periodically inspected to verify the integrity of all wiring and supports.
- To protect against electric shock or injury, electrical or mechanical inspections and maintenance should be performed by qualified personnel only and on a regular basis..
- **Do not** make modifications to the PV components (diode, junction box, plug connectors).
- Please refer to our Installation Manual Annex (Section Annex D: Module Cleaning Guide) for more information on module cleaning.

AMENDED EDITIONS AND DATES

- The first edition Rev 1.1 was released in Jan. 2009.
- Rev 2.1 was amended and released in Jan. 2011.
- Rev 2.2 was amended and released in Apr. 2012.
- Rev 2.3 was amended and released in Sep. 2012.
- Rev 2.4 was amended and released in May 2013.
- Rev 3.1 was amended and released in Apr. 2014.
- Rev 3.2 was amended and released in Dec. 2014.

CANADIAN SOLAR INC.

545 Speedvale Avenue West, Guelph, Ontario, Canada N1K 1E6

www.canadiansolar.com